# Offline comparison of KF3 and KF4 algorithms (P convergence)

This uses a downloaded binary IBG datalog as input data. In this example, the vario is using a MS5611 barometric sensor. The code is executed in an Ubuntu 20.04 console terminal.

In `config.h` choose the algorithm to run and set `LOG_CONVERGENCE` to 1.

E.g. if you want to check the KF3 algorithm convergence,

```
// choose one of the following tests
// print the kalman filter P convergence over first 512 samples of data
#define LOG_CONVERGENCE    1
// print the baro sensor derived altitude cm, and kalman filter estimates
for z and v, for all samples
#define LOG_INPUT_OUTPUT   0

// choose one of the following algorithms
// for LOG_CONVERGENCE run, only KF3 and KF4 are valid
#define USE_KF2 0
#define USE_KF3 1
#define USE_KF4 0
```

Build the code :

```
g++ -o kf_compare kf_compare.cpp kalmanfilter2.cpp kalmanfilter3.cpp kalm
anfilter4.cpp imu.cpp ringbuf.cpp -lm
```

Generate the results :

```
./kf_compare ./ms5611_datalog > kf3_ms5611_convergence.txt
```

In [1]:

```
import csv
import numpy as np
import matplotlib.pyplot as plt
```

In [2]:

```
z_kf3 = []
Pzz_kf3 = []
v_kf3 = []
Pvv_kf3 = []
with open('kf3_ms5611_convergence.txt', newline='') as csvfile:
    csvreader = csv.reader(csvfile, delimiter=' ')
    line = 0
    for row in csvreader:
        line = line+1
        # first two lines have log documentation
        if line > 2:
            z_kf3.append(float(row[0]))
            Pzz_kf3.append(float(row[1]))
            v_kf3.append(float(row[2]))
            Pvv_kf3.append(float(row[3]))
z_kf3 = np.array(z_kf3)
Pzz_kf3 = np.array(Pzz_kf3)
v_kf3 = np.array(v_kf3)
Pvv_kf3 = np.array(Pvv_kf3)
```

In [3]:

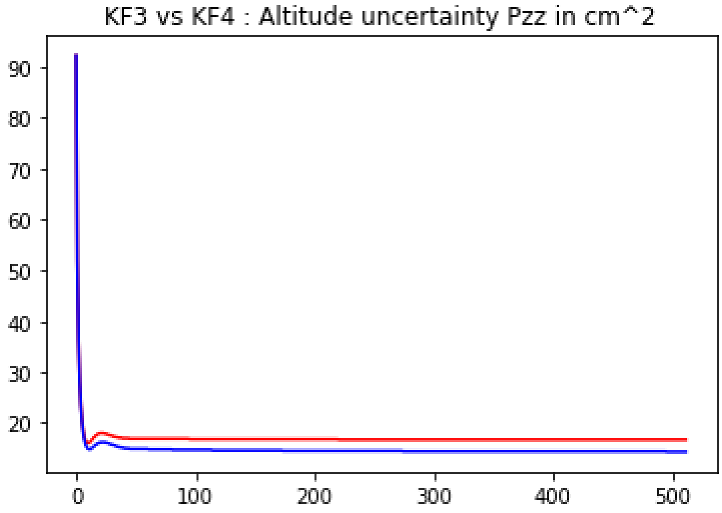
```
z_kf4 = []
Pzz_kf4 = []
v_kf4 = []
Pvv_kf4 = []
with open('kf4_ms5611_convergence.txt', newline='') as csvfile:
    csvreader = csv.reader(csvfile, delimiter=' ')
    line = 0
    for row in csvreader:
        line = line+1
        # first two lines have log documentation
        if line > 2:
            z_kf4.append(float(row[0]))
            Pzz_kf4.append(float(row[1]))
            v_kf4.append(float(row[2]))
            Pvv_kf4.append(float(row[3]))
z_kf4 = np.array(z_kf4)
Pzz_kf4 = np.array(Pzz_kf4)
v_kf4 = np.array(v_kf4)
Pvv_kf4 = np.array(Pvv_kf4)
```

## Pzz convergence

Plot altitude uncertainty convergence for the first 512 samples

In [4]:

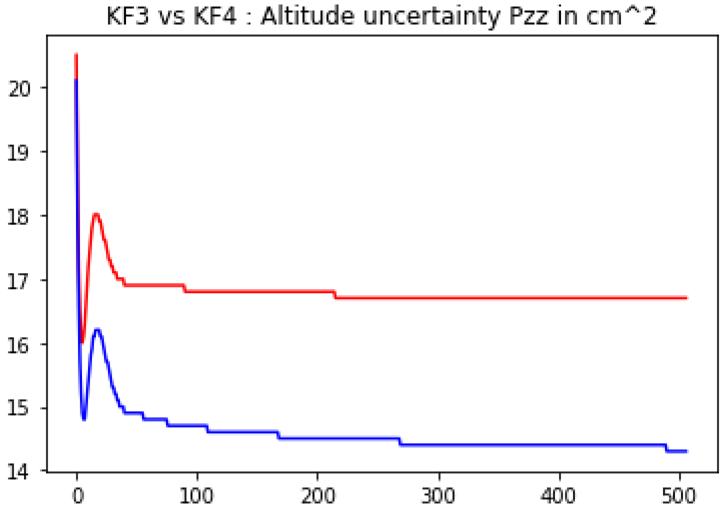
```
plt.plot(Pzz_kf3, color='red')
plt.plot(Pzz_kf4, color='blue')
plt.title('KF3 vs KF4 : Altitude uncertainty Pzz in cm^2')
plt.show()
```



Steep drop at start, so re-plot at starting offset 5 so that the difference in converged levels is clearer

In [5]:

```
plt.plot(Pzz_kf3[5:512], color='red')
plt.plot(Pzz_kf4[5:512], color='blue')
plt.title('KF3 vs KF4 : Altitude uncertainty Pzz in cm^2')
plt.show()
```

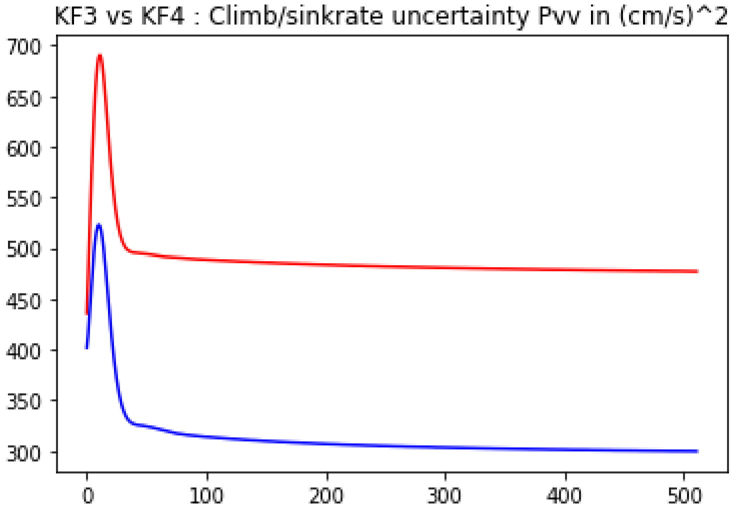


## Pvv convergence

Plot climb/sink rate uncertainty convergence for first 512 samples

In [6]:

```
plt.plot(Pvv_kf3, color='red')
plt.plot(Pvv_kf4, color='blue')
plt.title('KF3 vs KF4 : Climb/sinkrate uncertainty Pvv in (cm/s)^2')
plt.show()
```



In [ ]:

```
```